Results of forest insect and disease surveys in the SOUTHWESTERN REGION of Ontario, 1991

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

E.J. Czerwinski and W.D. Biggs

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FORESTRY CANADA, ONTARIO REGION

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RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE SOUTHWESTERN REGION OF ONTARIO 1991

Forest Districts:
Owen Sound, Wingham, Chatham, Aylmer and Simcoe

E.J. Czerwinski and W.D. Biggs

FORESTRY CANADA
ONTARIO REGION
GREAT LAKES FORESTRY CENTRE

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SURVEY HIGHLIGHTS

This report deals with forest insects, diseases and abiotic conditions encountered in the course of special and regular surveys carried out during the 1991 field season in the Southwestern Region of Ontario.

Although declining, the most noteworthy and damaging pest in the region was once again the forest tent caterpillar, which infested some 26,116 ha in Owen Sound District. Gypsy moth populations caused 3,388 ha of moderate-to-severe defoliation this year, down from 3,906 ha in 1990, although populations increased in the Chatham and Aylmer districts. For the first time since 1978, populations of the fall cankerworm caused moderate-to-severe defoliation. A new population of spruce budworm was recorded in Owen Sound District and existing populations in Wingham District decreased, causing only light defoliation in an 18-ha Agreement Forest. Cedar leafminer populations remained at endemic levels, as did oak leaf shredder populations. White pine weevil showed signs of a resurgence.

Butternut canker was found at five locations in Southwestern Region, representing the first discovery of this disease in Ontario. Diplodia tip blight continues to be a problem on exotic pines. Juvenile elms continue to be attacked by Dutch elm disease. Many foliar diseases were again common across the region and are listed in the table "Other forest diseases". Leaf scorch was evident this year across the southern portion of the region. Forest health plots continue to be monitored. Results of inspections in the St. Williams Forest Tree Nursery and a summary of climatic data for the region are also included in this report.

As in previous years, pests in this report are categorized as follows:

Major Insects or Diseases

capable of causing severe injury to or death of living trees or shrubs

Minor Insects or Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs.

Other Forest Insects and Diseases (Tables)

These tables provide information on two types of pest:

1) those that are of minor importance and have not been known to cause serious damage to forest trees, and

2) those that are capable of causing serious damage but have not done so because of low population levels or for other reasons.

The cooperation and assistance extended to the authors by staff of the Ontario Ministry of Natural Resources (OMNR), Conservation Authorities, the Canadian Parks Service, other government agencies and by private individuals are gratefully acknowledged.

If further information or additional copies of this report are required please contact the Chief, Forest Insect and Disease Survey, Forestry Canada, P.O. Box 490, Sault Ste. Marie, Ontario, P6A 5M7.

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An older butternut canker (*Sirococcus clavigignenti-juglandacearum* sp. nov.) is loosely covered by shredded bark (left). Beneath the bark, dark brown to black wood in an elliptical pattern is exposed (right). Coalescing cankers will eventually girdle and kill branches or stems.

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INSECTS

Major Insects

Fall Cankerworm,
Alsophila pometaria (Harr.)

For the first time since 1978, populations of the fall cankerworm were recorded in Southwestern Region.

In 1991, seven various-sized pockets of moderate-to-severe (40–100%) defoliation of sugar maple (*Acer saccharum* Marsh.) and silver maple (*A. saccharinum* L.), white elm (*Ulmus americana* L.) and white ash (*Fraxinus americana* L.) were delineated in Burford Township, Simcoe District. The damage was concentrated in lots 8, 9 and 10 in concessions III and IV, and totaled 51 ha. As well, a single 10-ha sugar maple woodlot sustained moderate-to-severe (25–80%) defoliation in lots 9 and 10 of Concession VI in Caradoc Township, Aylmer District. Light damage was also observed on roadside trees and in other stands in the aforementioned areas.

Spruce Budworm,
Choristoneura fumiferana (Clem.)

Provincial Situation

For the third consecutive year, an increase in the area of spruce budworm-defoliated stands was recorded in Ontario. In 1991, the overall area of moderate-to-severe defoliation increased to 9,065,781 ha, from 6,783,261 ha in 1990, and was concentrated in the Northwestern and North Central regions (Fig. 1). Extensions in the infestation were mapped in the northeastern corner of Wawa District and the southwestern side of Hearst District in the Northeastern and Northern regions, respectively. Infestations that were recorded in 1990 in the Northwestern and North Central re-

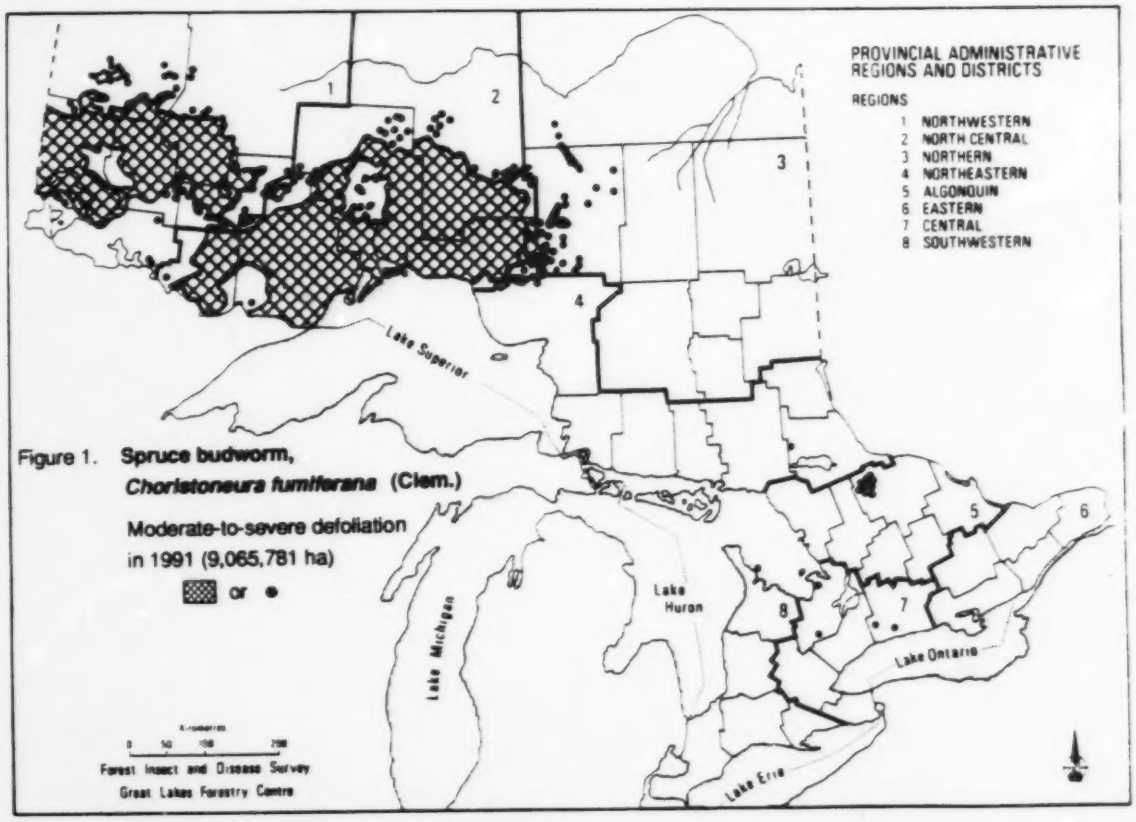

Figure 1. **Spruce budworm, *Choristoneura fumiferana* (Clem.)**

gions coalesced this year to form a single huge area of moderate-to-severe defoliation stretching from Hearst District west to the Manitoba border. Small satellite pockets of infestation were also mapped in the Sudbury and North Bay districts. Infestations in the Algonquin Region increased fourfold to 11,640 ha, and also occurred in small white spruce (*Picea glauca* [Moench] Voss) plantations in the Central and Southwestern regions.

Aerial surveys in 1991 to determine the area of budworm-caused mortality of balsam fir (*Abies balsamea* [L.] Mill.) and white spruce disclosed a total area of 3,736,379 ha in the Northwestern and North Central regions of the province. This represents an increase of some 638,190 ha over the area recorded in 1990. Most of the new mortality was recorded in the Nipigon and Terrace Bay districts of North Central Region, although increases in mortality were noted in all other districts in the North Central and Northwestern regions except Fort Frances.

Southwestern Region

This year, a new area of spruce budworm-caused damage was observed in Southwestern Region. Defoliation levels averaging 30% were recorded in a 20-ha block of 10-m white spruce in the Brant Tract in Brant Township, Owen Sound District. Once again, populations of the spruce budworm were recorded on 15-m white spruce in an 18-ha plantation in the Smeale Tract in Minto Township, Wingham District. Defoliation levels there averaged 20% in 1991 as compared with 33% in 1990.

As in past years, egg-mass sampling for the purpose of forecasting population levels was conducted at five locations in the region. The results indicate that moderate-to-severe damage is likely to occur in the spruce plantation in Minto Township of Wingham District and populations will remain at endemic levels at all other locations sampled.

Larch Casebearer,
Coleophora laricella (Hbn.)

Population levels of this early-season defoliator of European larch (*Larix decidua* Mill.) and tamarack (*L. laricina* [Du Roi] K. Koch) were high at two sites in the region in 1991.

Foliar damage ranged from 75 to 100% in a mature European larch plantation approximately 0.2 ha in size near Simcoe in Charlotteville Township, Simcoe District. Moderate-to-severe (26–60%) defoliation, in the form of needle discoloration and premature needle drop, was also recorded on European larch in shelterbelts and windbreaks at the St. Williams Forest Tree Nursery, Simcoe District. Low population levels of the larch casebearer were observed causing light damage at widely scattered locations across the region.

Oak Leaf Shredder,
Croesia semipurpurana (Kft.)

No populations of the oak leaf shredder were detected in 1991 in Southwestern Region. Annual surveys in oak (*Quercus* spp.) plots in Bosanquet Township, Chatham District, and Charlotteville Township, Simcoe District, revealed no foliar damage on red oak (*Quercus rubra* L.) and black oak (*Q. velutina* Lam.) as a result of feeding by this pest.

The results of pheromone trapping, defoliation estimates in 1991, and egg surveys to forecast infestations for 1992 are presented in Table 1. An analysis of the data indicates that populations of the oak leaf shredder may cause light defoliation in the Simcoe District plot but will be absent from the Chatham District plot in 1992.

Gypsy Moth,
Lymantria dispar (L.)

In 1991, there was an overall decrease in the area affected by the gypsy moth for the first time since this insect was found in Southwestern Region. The greatest decrease occurred in the oldest part of the outbreak in Simcoe District, while small increases were noted in the Aylmer and Chatham districts. The gross area of moderate-to-severe defoliation in the region totaled 3,388 ha, which represents less than 1% of the area encompassed by the provincial outbreak, which now totals 347,415 ha, an increase of more than 270,000 ha since 1990.

Table 1. Results of oak leaf shredder pheromone trapping, defoliation estimates, egg counts in 1991 and defoliation forecasts for 1992 in the Southwestern Region of Ontario. (Five pheromone traps with a concentration level of 0.003% were deployed at each location.)

Location (Twp)	Number of adults caught 1990	Number of adults caught 1991	Leaves attacked in 1991 (%)	Foliar damage in 1991 (%)	Number of eggs 1990	Number of eggs 1991	Infestation forecast for 1992
Chatham District							
Bosanquet	0	52	0	0	0	0	nil
Simcoe District							
Charlotteville	1	0[a]	0	0	4	1	light

[a] All traps were vandalized.

The majority of the infestation (3,098 ha in 1991) was once again observed in Simcoe District, but this represents a decrease from the 3,856 ha reported in 1990. In 1991, the majority of the infestations were observed in Middleton Township, with small satellite pockets in northern Houghton and North Walsingham townships (Fig. 2). Together with the aforementioned infestations, small pockets of moderate-to-severe defoliation were recorded on oak north of Simcoe, east of Windham Centre and west and north of Vanessa in Windham and Burford townships, Simcoe District. Small pockets were also mapped further east in the district, south of Jarvis in Woodhouse Township and in Rainham Township, which was part of a larger infestation in adjacent Niagara District, Central Region. Foliar damage on deciduous and coniferous hosts was recorded at the 45–100% level. The most severe foliar damage was observed near Mabee's Corners, Burford Township, Simcoe District, where complete defoliation of black oak was recorded. Small numbers of larvae were also observed in the previously infested area of Simcoe District in the southern portion of the region. The major portion of the infestation in 1990 consisted of many different-sized pockets in woodlots in North Walsingham, Middleton and Charlotteville townships and in the southern part of Windham Township, Simcoe District. Small pockets were mapped north of Waterford in Townsend Township and east of Simcoe in Woodhouse Township.

Moderate-to-severe defoliation aerially mapped in 1991 increased to 230 ha in Aylmer District and 80 ha in Chatham District compared with 30 and 20 ha, respectively, in 1990. In Aylmer District, moderate-to-severe (65–100%) defoliation was once again delineated east and west of Straffordville in Bayham Township. New pockets of severe (100%) foliar damage were recorded in the Springwater Conservation Forest Area and to the east in a private woodlot, both in Malahide Township, Aylmer District. In Chatham District, surveys southeast of Brigden in Moore Township revealed three small pockets of 45 to 80% defoliation. For the first time, moderate-to-severe defoliation was recorded in three provincial parks (Rondeau, Pinery and Wheatley) in Chatham District. At Rondeau Provincial Park, Harwich Township, Chatham District, a line search in the fall of 1990 revealed 190 egg-masses, and defoliation in 1991 ranged from 65 to 95% on red oak, black oak and eastern white pine (*Pinus strobus* L.). The infestation was approximately 1.5 km long and 100 m wide adjacent to the Lakeshore road. White oak (*Q. alba* L.) and black oak at Pinery Provincial Park, Bosanquet Township, were moderately defoliated in a 0.5-ha area near the Nipissing Beach Trail entrance. In Wheatley Provincial Park, Romney Township, mature red oak on the eastern side of the park sustained severe (80–100%) defoliation in a 0.8-ha area. Elsewhere, low population levels of gypsy moth were found in the northwestern part of the Cape Croker Indian Reserve, and near Hope Bay and Cabot Head Lighthouse along the eastern side of the Bruce Peninsula, Owen Sound District.

Damage assessments at Turkey Point Provincial Park, Charlotteville Township, Simcoe District, disclosed that 32.0% of the trees examined in

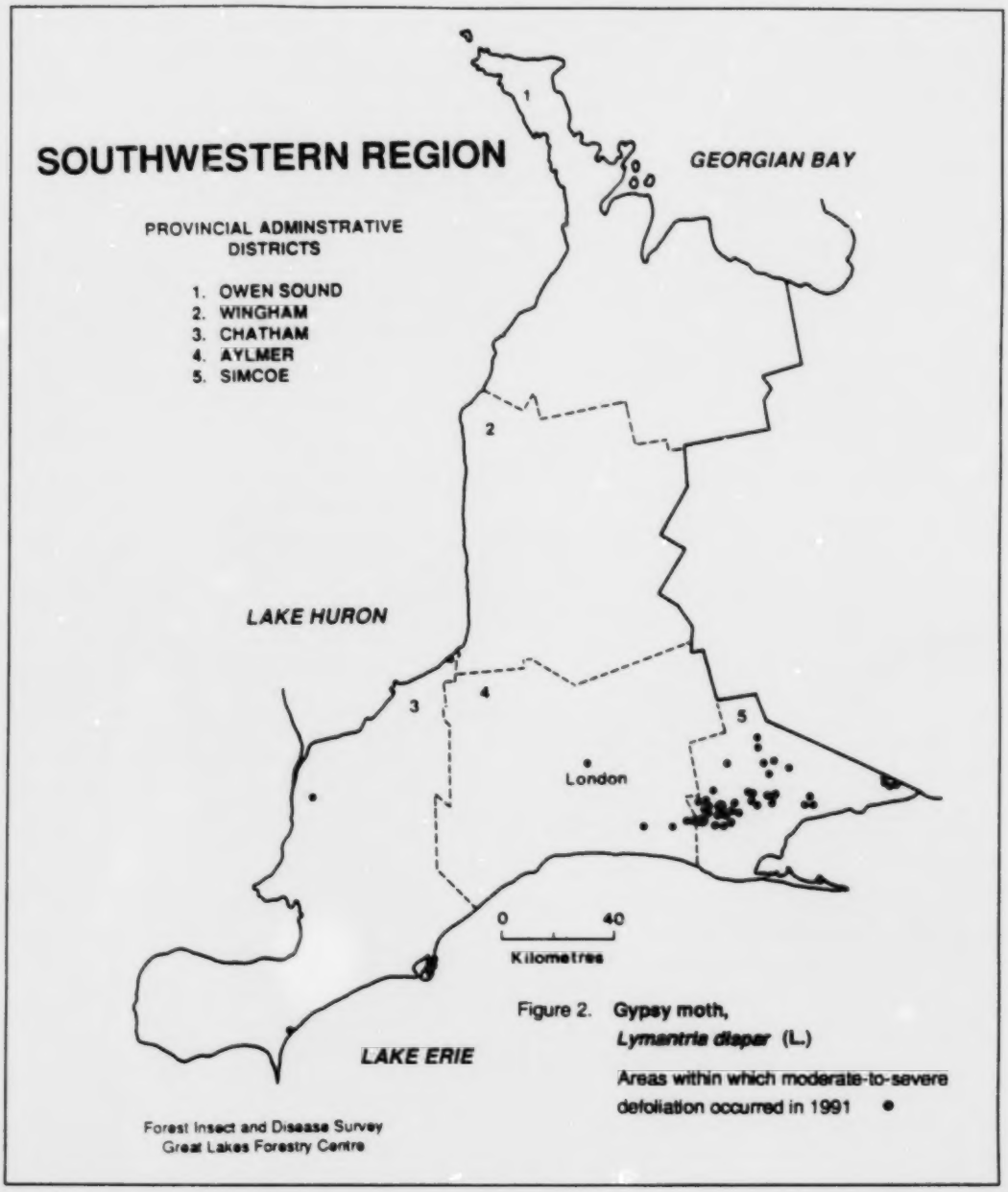

Figure 2. Gypsy moth, *Lymantria dispar* (L.)

1991 were dead, compared with 22.7% in 1990. The 1991 assessment, primarily in an oak/pine forest totaling 170 ha, revealed 40.9% cumulative mortality of the eastern white pine (Table 2). The cruise also revealed that one red oak died in 1991, bringing the total oak-component mortality to 5.4%. Infections by Armillaria root rot (*Armillaria ostoyae* [Romagn.] Herink) and activity by the two-lined chestnut borer (*Agrilus bilineatus* [Web.]) contributed to the oak mortality. Many mature white oak were also noted as dead within the park area; however, none were on the cruise line. Defoliation near 10% was recorded this year.

Table 2. Summary of gypsy moth-associated tree mortality, by tree species, based on ground checks in Turkey Point Provincial Park, Charlotteville Township, Simcoe District, in 1991.

Tree species	Average stand height (m)	Average DBH (cm)	Total trees	Cumulative whole-tree mortality 1990	Cumulative whole-tree mortality 1991	Total mortality (%)
				Number of trees		
Norway spruce[a]	21.0	22.0	7	7	7	100.0
Jack pine[b]		15.1	5	5	5	100.0
Eastern white pine		18.1	22	4	9	40.9
Oak (black, red and white)		31.2	37	1[c]	2[d]	5.4
Scots pine[e]		6.7	2	0	1	50.0
Black cherry[f]		16.7	2	0	0	0.0

[a] *Picea abies* (L.) Karst.
[b] *Pinus banksiana* Lamb.
[c] Windthrown
[d] Armillaria root rot and two-lined chestnut borer activity
[e] *Pinus sylvestris* L.
[f] *Prunus serotina* Ehrh.

Ten burlap and three pheromone traps were again deployed in each of four parks in Southwestern Region (Table 3). The burlap larval traps were examined by park staff four times between 8 June and 9 July. All larvae were counted and then destroyed. The pheromone traps were of the non-saturating bucket type to hold the large number of moths that were expected.

The burlap trapping revealed more than 12,500 larvae at Rondeau Provincial Park. Increases were noted at Selkirk and Turkey Point provincial parks, and there was a decrease in the numbers recorded at Pinery Provincial Park. The results from the pheromone trapping show a similarly large number (more than 5,300) of male moths caught at Rondeau Provincial Park. The number of moths captured at Pinery and Selkirk provincial parks were slightly higher in 1991, whereas the numbers of male moths captured at Turkey Point Provincial Park remained relatively constant.

In all parks in which burlap and pheromone trapping were carried out, a line search was completed to detect the presence of gypsy moth egg masses. The greatest egg-mass density was again encountered in Rondeau Provincial Park, where 668 egg masses were observed on a single line search in 1991. These surveys, and general obser-

Table 3. Results of the gypsy moth burlap and pheromone trapping programs, defoliation estimates and egg-mass surveys in the Southwestern Region of Ontario in 1990 and 1991.

Location (Provincial Park)	Number of larvae 1990	Number of larvae 1991	Estimated defoliation (%) 1990	Estimated defoliation (%) 1991	Number of male moths caught 1990	Number of male moths caught 1991	Total number of egg masses[a]
Chatham District							
Pinery	230	50	5	2	493	1,137	2
Rondeau	7,022	12,559	5	95	864[b]	5,311	668
Simcoe District							
Selkirk	82	122	5	2	271	358[b]	0
Turkey Point	61	124	20	4	1,260	1,290	3

[a] by the line-search method
[b] One pheromone trap was vandalized.

vations made during routine surveys, indicate that infestations will continue to grow and expand in Chatham District in 1992, especially at Rondeau and Wheatley provincial parks. Surveys revealed that the infestations near the Nipissing Beach Trail entrance of Pinery Provincial Park will probably continue to expand, causing moderate-to-severe defoliation, but that population levels will remain low elsewhere in the park. In Simcoe District, infestations will probably remain light in the two parks surveyed.

In 1991, spray programs were initiated in the Simcoe and Chatham districts to protect foliage from feeding by the gypsy moth. Approximately 190 ha of provincially managed woodlots and 4,000 ha of private land were aerially sprayed with *Bacillus thuringiensis* (B.t.), a biological insecticide. As well, a research spray program was carried out in 90 ha of forests by the Forest Pest Management Institute of Forestry Canada. These stands were treated with biological pesticides based on gypsy moth viruses, Gypcheck and Dispar.

Forest Tent Caterpillar,
Malacosoma disstria Hbn.

The gross area of moderate-to-severe defoliation caused by the forest tent caterpillar decreased in Owen Sound District in 1991. The infestation totaled 26,116 ha, a decline of more than 36,000 ha from the 62,889 ha mapped in 1990. This area represents less than 1% of the area affected by the provincial outbreak, which now totals 18,870,508 ha, an increase of more than 9 million ha since 1990 (Table 4).

Table 4. Gross area of moderate-to-severe defoliation by the forest tent caterpillar in Owen Sound District and in Ontario from 1986 to 1991.

	Gross area of moderate-to-severe defoliation (ha)	
Year	Owen Sound District	Ontario
1986	0	433,000
1987	0	1,649,977
1988	4,760	3,965,229
1989	46,290	7,915,111
1990	62,889	9,480,408
1991	26,116	18,870,508

In 1991, severe (75–100%) defoliation of sugar maple and trembling aspen (*Populus tremuloides* Michx.) occurred over most of the Cape Croker Indian Reserve, and on Hay and White Cloud islands; near Lion's Head in Eastnor Township; and at numerous points in Albemarle Township (Fig. 3). Several smaller pockets of moderate and severe defoliation were also present in Amabel, Keppel, Sullivan, Sydenham, Holland, St. Vincent, Derby, Arran and Euphrasia townships, but in comparison with 1990 there were fewer pockets and they were smaller. Large numbers of late-instar larvae were found dead on the stems of trees at many locations, a result of infections by a fungus of the genus *Entomophthora*.

Egg-band sampling for the purpose of forecasting 1992 infestations was conducted at eight locations in Owen Sound District (Fig. 4). The results of this survey indicate that infestations will collapse in 1992 throughout Owen Sound District (Table 5).

European Pine Sawfly,
Neodiprion sertifer (Geoff.)

Populations of the European pine sawfly, a serious pest of Scots pine, were widespread in 1991, but were generally recorded at low levels in the region.

Evaluations in 1.5- to 7.0-ha Scots pine Christmas tree plantations revealed that the proportion of trees infested was as high as 92% but defoliation was less than 15%. The most severely infested plantation was in Burford Township, Simcoe District. In this 3-ha plantation, 79.0% of the 2.5-m trees sustained an average of 10% defoliation; however, some trees were recorded with defoliation as high as 45%. In Charlotteville Township, Simcoe District, 80% of the trees in a 2.5-ha plantation supported as many as 12 colonies per tree in 1990, and the plantation was treated with the "sertifer" viral insecticide. This insecticide application was done in cooperation with the landowner and Dr. J. Cunningham of the Forest Pest Management Institute of Forestry Canada. In 1991, an evaluation in the same plantation revealed that only 2.7% of the trees were infested, with an average of

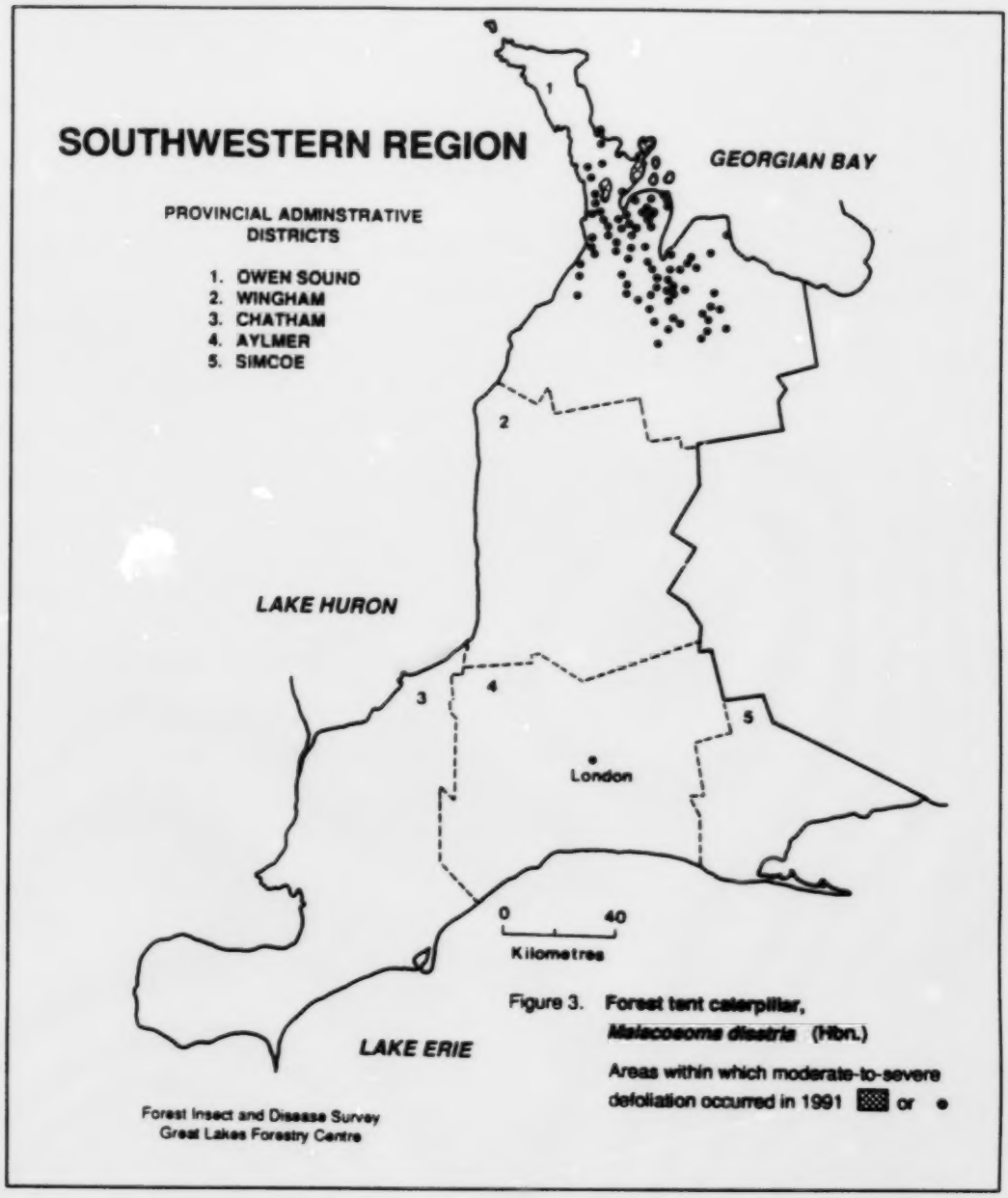

Figure 3. Forest tent caterpillar, *Malacosoma disstria* (Hbn.)
Areas within which moderate-to-severe defoliation occurred in 1991 ▩ or ●

one colony per tree, and <5% defoliation was recorded on the infested trees.

Trace populations were noted at many scattered locations across the region in the Aylmer, Chatham and Owen Sound districts.

White Pine Weevil,
Pissodes strobi (Peck)

The results of surveys conducted in 1991 indicated that white pine weevil populations remained at low levels, except at two widely separated sites in Southwestern Region.

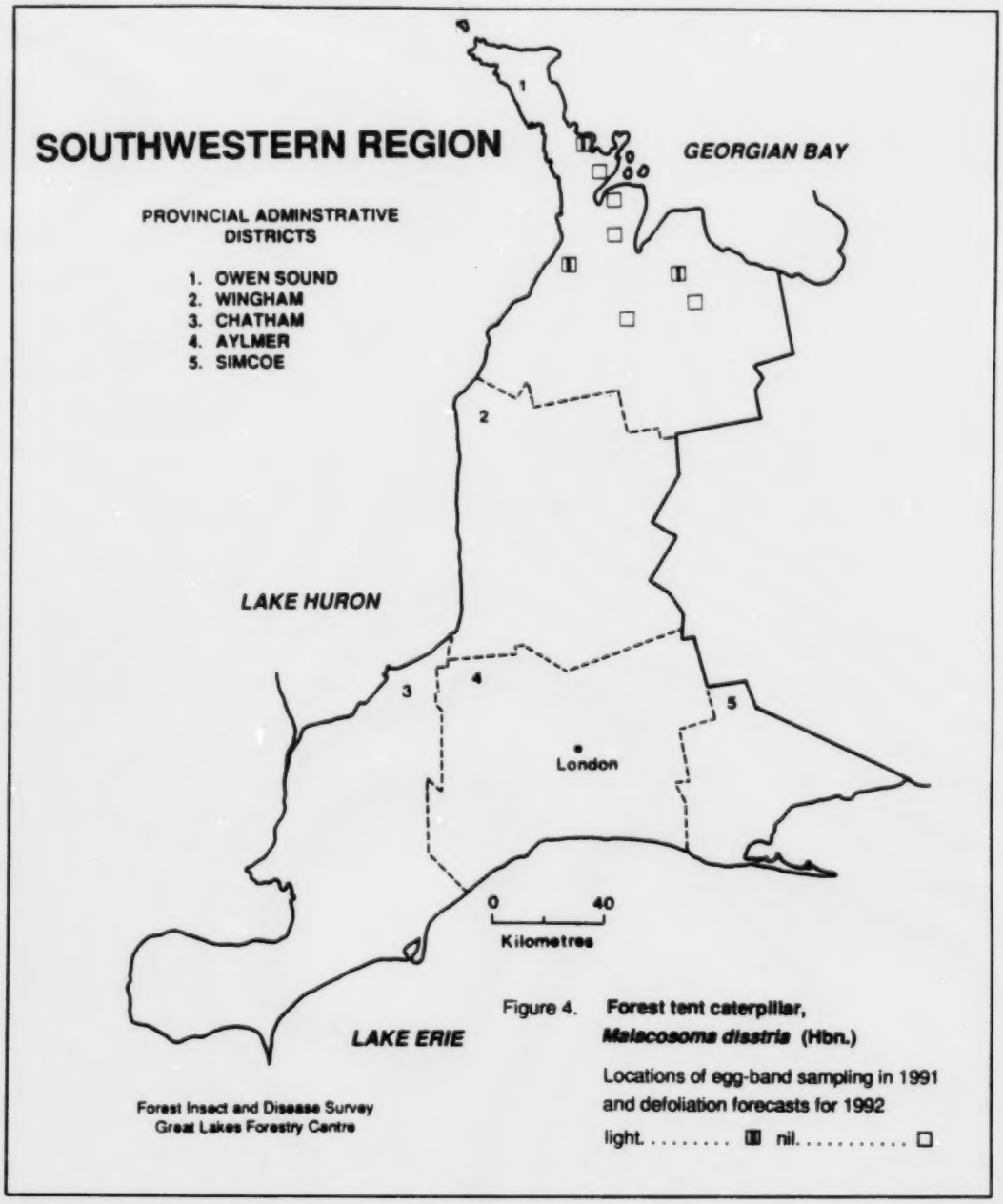

Figure 4. **Forest tent caterpillar, *Malacosoma disstria* (Hbn.)**

Locations of egg-band sampling in 1991 and defoliation forecasts for 1992

light..... ▥ nil..... □

A total of 11 eastern white pine plantations, 1.3 to 5.9 m in height, were assessed in 1991, and only three had trees with leader damage. In the southern portion of the region, appreciable damage was recorded in a 2-ha plantation in Charlotteville Township, Simcoe District. At this site, 8.0% of the 2.6-m trees had leader damage. In another plantation in Charlotteville Township, 1.3% of the trees were infested. In the northern portion of the region, damage levels of 5% were observed on 2.3-m trees in a 0.3-ha eastern white pine plantation in Sydenham Township, Owen Sound District.

Table 5. Forest tent caterpillar egg-band counts at eight locations in the Southwestern Region of Ontario in 1991, with infestation forecasts for 1992 in Owen Sound District.

Location (Twp)	Host[a]	Average DBH of trees (cm)	Average number of egg bands per tree	Infestation forecast for 1992
Albemarle	tA	14	0	nil
Amabel	sM	15	3	light
Eastnor	sM	15	2	light
Holland	sM	15	<1	nil
Keppel Conc. I	tA	13	0	nil
Keppel Conc. XXII	sM	15	0	nil
Sullivan	sM	14	<1	nil
Sydenham	sM	15	5	light

[a] tA = trembling aspen, sM = sugar maple

Reports from OMNR in the Wingham and Owen Sound districts indicated that clipping infested leaders was necessary as a control method to contain populations of the weevil.

Minor Insects

Maple Webworm,
Tetralopha asperatella (Clem.)

Maple webworm population levels have been high in the northern part of the region for 2 years, but a decrease was recorded in 1991. The largest populations were predominantly in the same sugar maple stands previously defoliated by the forest tent caterpillar in Owen Sound District. In 1990, when peak population levels were recorded, the webworm defoliated 100% of the remaining foliage in many stands throughout Eastnor, Albemarle, Keppel, Sydenham, Euphrasia, Holland and Sullivan townships. This year, however, sporadic low-to-moderate defoliation occurred in stands in Owen Sound District. Trace levels were also noted at several locations in the Simcoe, Aylmer and Wingham districts.

Table 6. Other forest insects.

Insect	Host(s)	Remarks
Acantholyda erythrocephala (L.) Pine false webworm	ewP	Defoliation levels of 30% were found on 1.5-m host trees in a 3-ha area in Sullivan Twp, Owen Sound District.
Agrilus bilineatus (Web.) Twolined chestnut borer	bO	Large numbers of woodborers contributed to whole-tree mortality in a forest previously damaged by drought and the gypsy moth in Turkey Point Provincial Park, Charlotteville Twp, Simcoe District.
Anisota finlaysoni Riotte Shorthorned oakworm	wO	A single mature, open-growing tree sustained 100% defoliation in Walpole Twp, Simcoe District.
Anisota senatoria (J.E. Smith) Orangestriped oakworm	rO	Small numbers were commonly found on the lower branches of host trees in North Dorchester Twp, Aylmer District.
Bucculatrix canadensisella Cham. Birch skeletonizer	wB	Various-sized pockets of heavy (80–100%) foliar browning were observed in Collingwood, Amabel, Keppel and Albemarle twps, Owen Sound District.

(cont'd)

Table 6. Other forest insects (concl.).

Insect	Host(s)	Remarks
Coleophora ulmifoliella McD. Elm casebearer	wE	Moderate populations caused 45% defoliation to understory trees in a 20-ha woodlot in Townsend Twp, Simcoe District.
Corythucha celtides O. & D. Hackberry lace bug	Ha	This insect caused 100% defoliation to trees in 1- to 2-ha pockets scattered throughout Point Pelee National Park, Mersea Twp, Chatham District.
Datana integerrima G. & R. Walnut caterpillar	blW	Defoliation ranged from 40 to 100% at scattered locations through the Aylmer and Simcoe districts.
Diapheromera femorata (Say) Walking stick	Oak	Small numbers were commonly found throughout Norfolk County, Simcoe District.
Dryocampa rubicunda (F.) Greenstriped mapleworm	rM	Several trees at one location sustained 5% defoliation in Dunwich Twp, Aylmer District.
Fenusa pusilla (Lep.) Birch leafminer	wB	High population levels continued to cause 75% foliar browning to ornamentals at scattered locations in the Aylmer and Simcoe districts.
Halysidota harrisii Walsh. Sycamore tussock moth	Sy	An 18-m tree sustained 35% defoliation in Charlotteville Twp, Simcoe District.
Hyphantria cunea (Drury) Fall webworm	wAs, wE, blW	Slight increases in populations and incidence were noted in the southern portion of the region this year. Tents were commonly observed covering trees throughout the Aylmer and Simcoe districts. Smaller numbers of tents were noted in Chatham District.
Japanogromyza viridula (Coq.) Leafminer	wO	Foliar damage was recorded at the 75–100% level through 28 ha of Rondeau Point, Harwich Twp, Chatham District. Light foliar browning was also noted at Wheatley Provincial Park, Chatham District, and at many locations in Simcoe District.
Phigalia titea (Cram.) Spiny looper	mM	Defoliation averaged 85% on six roadside trees at one location in Burford Twp, Simcoe District.
Plagiodera versicolora (Laich.) Imported willow leaf beetle	W	Large populations caused 80–100% foliar browning on 19-m trees along riverbanks and in lowlying areas throughout the region.
Pristiphora geniculata (Htg.) Mountain-ash sawfly	sMo	Small numbers were recorded causing 20% defoliation on ornamental trees in Blanshard Twp, Wingham District.
Rhynchaenus rufipes (LeC.) Willow flee weevil	W	Foliar browning averaging 85% was observed on 100% of the roadside trees at scattered locations in the Aylmer, Chatham and Wingham districts.

TREE DISEASES

Major Diseases

Dutch Elm Disease,
Ophiostoma ulmi (Buisman) Nannf.

This disease continues to devastate juvenile elm in woodlots and along riverbanks and fencerows throughout Southwestern Region in 1991.

Evaluations were conducted in small groups of elm ranging from 7.5 to 14.0 m in height at widely separated points in the region. Assessments in the Aylmer, Simcoe and Wingham districts disclosed infection levels ranging from 2.9 to 27.3% and mortality that ranged from 2.9 to 68.2%. In Owen Sound District, 10 dead trees were recorded along Highway 26 in St. Vincent Township, and five 12-m trees were dead in a small cluster of elm in Collingwood Township. Dieback levels of 80% were observed on 20% of the trees at one site in Bruce Township, Owen Sound District.

Butternut Canker,
Sirococcus clavigignenti–juglandacearum Nair, Kostichka & Kuntz

Surveys for the butternut canker were conducted at nine locations in the region in 1991 (Fig. 5). The fungus was collected at five of the sites, representing the first collections of this fungus in Ontario.

Where butternut cankers were observed, branch mortality ranged from 20 to 80% on average 13-m trees. The most severely affected location was at Ipperwash Provincial Park, Bosanquet Township, Chatham District, where 80% branch mortality was found. At the Parkhill Conservation Area, McGillivray Township, Aylmer District, several 17-m trees in the von Althen Plantations were attacked, and had as much as 75% branch dieback.

Butternut (*Juglans cinerea* L.) is known to occur on rich, moist soils, in small groups or as a single tree, in association with other hardwoods in woodlots across Southwestern Region. Butternut is not found in abundance and with the presence of butternut canker, it may become even more scarce. Although this is the first report of butternut canker in Ontario, the disease has probably been present for several years, since many of the trees examined this year had many older cankers and branch mortality. The disease is causing extensive tree mortality in areas where it has become established since its discovery in the north-central United States in 1967.

Butternut canker attacks all ages and sizes of trees. It appears to be most virulent when there are several trees growing in close proximity in a woodlot. The canker often originates at leaf scars, buds and other wounds, and appears sunken. The cankers, fusiform in shape, eventually girdle branches and main stems and cause branch and whole-tree mortality after several years. As the stem and branch cankers age, they may become loosely covered with shredded bark and bordered by successive callus layers. In spring, the canker exudes a thin, inky-black fluid. As the summer progresses, sooty patches with whitish margins commonly appear. The cankered area is usually rapidly invaded by a secondary fungus, *Melanconis juglandis* (Ell. & Ev.) Graves, which makes the primary fungus difficult to isolate. Beneath the bark, dark-brown elliptical patterns are evident (see Frontispiece).

Diplodia Tip Blight,
Sphaeropsis sapinea (Fr.) Dyko & B. Sutton

This fungus continues to be a cause of significant twig mortality and dieback in ornamental plantings of exotic and native pines. Damage was noted to a lesser extent in Christmas tree plantations in the southern portion of the region.

Ornamental and roadside plantings of Austrian pine (*P. nigra* Arnold) sustained extensive branch and occasional whole-tree mortality in some towns and cities in the Wingham, Aylmer and Simcoe districts. In 1991, surveys revealed an overall average of 37.6% foliar damage on 51.9% of the Austrian pine in roadside plantings across the region. This disease was particularly virulent on 17.5-m roadside trees in Morris Township, Wingham District, where an assessment disclosed that 80% of the trees sustained 61.2% branch dieback. Evaluations in Austrian pine plantings along High-

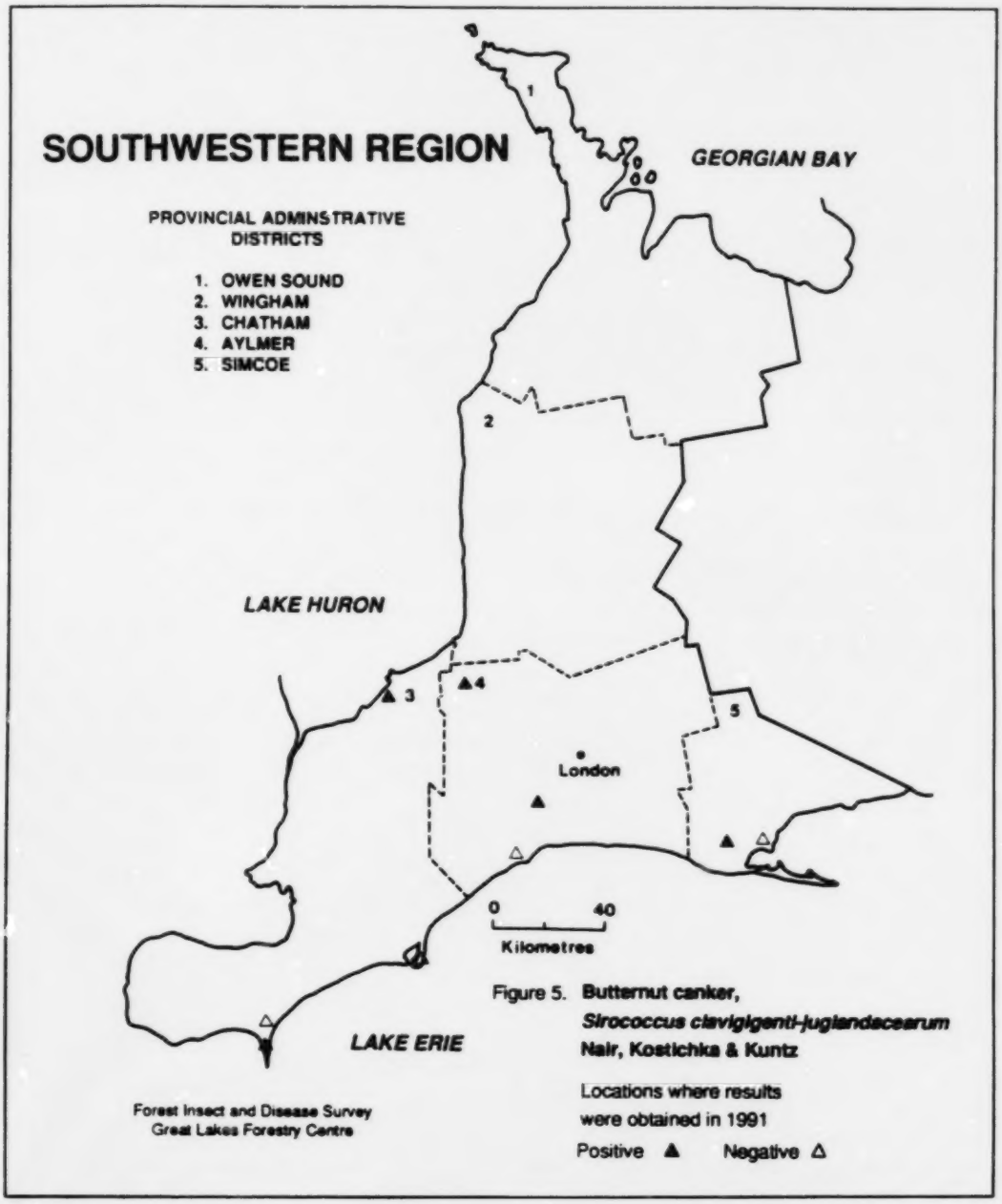

Figure 5. **Butternut canker, *Sirococcus clavigigenti-juglandacearum* Nair, Kostichka & Kuntz**

way 401 revealed lower damage levels. The average foliar damage ranged from 20 to 41.8% at three widely separated locations, with 14.5 to 75% of the 10.5-m trees attacked. Light foliar damage was also recorded on 20% of the 2.5-m trees in one 2-ha Scots pine Christmas tree plantation in Burford Township, Simcoe District.

Table 7. Other forest diseases.

Organism	Host(s)	Remarks
Asteroma caryae (Peck) B. Sutton Hickory leaf spot	Hi	Foliar damage ranged from 80 to 100% in woodlots through the Chatham, Aylmer and eastern Simcoe districts.
Aureobasidium apocryptum (Ell. & Ev.) Hermanides–Nijhof Anthracnose	sM NM	Evaluations on open-growing and roadside trees disclosed 100% foliar damage on 80% of the trees at scattered locations through the Aylmer and Simcoe districts.
Endocronartium harknessii (J.P. Moore) Y. Hirats. Western gall rust	ScP	20% of the 1.8-m trees in a 2.5-ha plantation were severely affected in Charlotteville Twp, Simcoe District
Gymnosporangium juniperi–virginianae Schwein. Cedar-apple rust	rJ	100% of the trees had <2% of the branches attacked at one location each in Charlotteville and Southwold twps, Simcoe and Aylmer districts, respectively
Uncinula flexuosa Peck Powdery mildew	hCh	A few trees at one location sustained 100% foliar browning in Southwold Twp, Aylmer District.
Verticillium albo–atrum Reinke & Berth. Verticillium wilt	Ca	Single-tree infections caused 50% crown dieback on ornamentals in the cities of Delhi and Simcoe, Simcoe District.

ABIOTIC DAMAGE

Leaf Scorch

Severe damage as a result of leaf scorch was widespread in Southwestern Region in 1991. Leaf scorch occurs in association with prolonged periods of severe, warm and drying winds that cause a sudden loss of water from the leaves. The water in the leaves cannot be replaced by the roots because of root damage, poor root development or because of low soil moisture. The largest single area of damage was in East Oxford Township, Simcoe District, where a 22-ha red maple (*A. rubrum* L.) woodlot sustained 100% leaf scorch and premature leaf drop. Assessments through Essex and Kent counties, Chatham District, disclosed roadside red maple and red oak with 40 to 100% foliar damage. The damage in Chatham District was mainly confined to the upper portions of the tree. Evaluations at several locations revealed an average of 34% defoliation on 20 to 67% of the trees. Roadside sugar maple in the Aylmer and Wingham districts sustained lower levels of damage.

FOREST HEALTH

Oak Health

Three oak health plots in Southwestern Region were assessed for the 15th consecutive year and tree conditions for the past 5 years are summarized in Table 8. A standard classification system has been used to record the cumulative dieback levels in each tree's crown; however, the "current dieback" category is no longer recorded in the field. The first two classification categories (0 and 1) are considered to represent light (0–20%) cumulative dieback, which may be normal in forest stands.

In Chatham District, the plot in Bosanquet Township revealed small increases in the extent of crown damage. Two additional trees died, one as a result of infections by Armillaria root rot and the other was windthrown. This brought total mortality to 16 trees, and two trees moved into the third (41–60%) cumulative dieback class. In Simcoe District, the oak plot in Charlotteville Township showed a decrease in cumulative crown dieback for

the first time; 75 trees were recorded as having <20% dieback, versus only 38 of the trees in 1990. Five trees in the plot sustained light (5–20%) defoliation by the gypsy moth this year, whereas in 1989 and 1990 all trees sustained defoliation in the light-to-moderate (5–50%) foliar damage range. In the South Walsingham Township oak plot, defoliation by the gypsy moth averaged 15% and ranged from 5 to 35% throughout the stand. Four additional trees succumbed to infections by Armillaria root rot, accounting for the increase in mortality; however, crown deterioration remained relatively constant.

Maple Health

In 1987, 10 maple health plots were established in woodlots in Southwestern Region. Since then, the program has expanded to include an additonal six urban plots and six rural plots, of which 10 were established in 1989 and two were added in 1990. In Owen Sound District, an additional five woodlot plots were established in sugar maple stands in which control operations against the forest tent caterpillar had taken place in 1989. This year, an additional three plots were established in woodlots that sustained severe defoliation in 1989 and 1990, but which did not have control operations carried out at any time.

In the 10 woodlot study plots (Table 9), no significant change has occurred in the cumulative crown conditions. The only changes worth noting in 1991 were in West Oxford Township, Aylmer District, where the crown of a tree was snapped off by the wind. In Plympton Township, Chatham District, a single tree died from a Nectria stem canker (*Nectria* sp.) infection. In the three newly established plots, the majority of the trees had less than 20% crown dieback, except in the Holland Township plot in Owen Sound District, where 10 trees were in the 21–40% dieback class and two trees were dead. Otherwise, all remaining woodlot plots were in good condition.

Table 8. Oak health at three locations in the Southwestern Region of Ontario from 1987 to 1990.

Location (Twp)	Average DBH[a] (cm)	Number of trees examined	Year	Cumulative dieback class[b] 0	1	2	3	4	5	Trees blown down or cut
				← Number of trees →						
Chatham District										
Bosanquet	29	100	1987	75	14	0	1	4	5	0
		100	1988	74	12	0	2	4	6	1
		100	1989	50	29	7	1	1	11	1
		100	1990	41	31	10	0	4	13	1
		100	1991	42	30	6	2	4	14	2
Simcoe District										
Charlotteville	32	101	1987	35	57	4	2	1	2	0
		101	1988	42	47	8	1	1	2	0
		101	1989	3	54	37	1	1	3	2
		100	1990	1	37	49	8	0	3	2
		100	1991	25	50	20	0	0	3	2
South Walsingham	22	110	1987	81	17	1	0	0	11	0
		110	1988	82	13	3	0	1	11	0
		110	1989	54	29	9	0	6	11	1
		110	1990	34	40	14	2	6	13	1
		100	1991	49	24	8	0	1	17	1

[a] from 1977 measurements

[b] 0 = 0–5%, 1 = 6–20%, 2 = 21–40%, 3 = 41–60%, 4 = 61–100%, 5 = dead tree

Table 9. Maple health at 18 woodlot locations in the Southwestern Region of Ontario from 1987 to 1991 (25 maple trees examined at each location).

Location (Twp)	Average DBH (cm)	Average height (m)	Year	Cumulative dieback class[a] 0	1	2	3	4	5	Trees blown down or cut
				← Number of trees →						
Aylmer District										
Malahide	35.3	22	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	24	1	0	0	0	0	0
			1990	22	3	0	0	0	0	0
			1991	22	3	0	0	0	0	0
West Oxford	27.1	21	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	23	1	0	0	0	1	0
			1990	24	0	0	0	0	1	0
			1991	21	2	0	0	0	1	1
Chatham District										
Plympton	29.3	22	1987	24	1	0	0	0	0	0
			1988	23	2	0	0	0	0	0
			1989	23	0	1	1	0	0	0
			1990	21	1	1	0	1	0	1
			1991	22	0	0	1	0	1	1
Warwick	31.3	27	1987	24	1	0	0	0	0	0
			1988	22	1	0	0	1	0	1
			1989	21	1	0	0	1	1	1
			1990	21	1	0	0	0	2	1
			1991	22	0	0	0	0	2	1
Owen Sound District										
Derby	31.6	24	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	0
			1990	25	0	0	0	0	0	0
			1991	25	0	0	0	0	0	0
Sullivan	42.2	26	1987	25	0	0	0	0	0	0
			1988	24	1	0	0	0	0	0
			1989	24	1	0	0	0	0	0
			1990	24	1	0	0	0	0	0
			1991	20	4	1	0	0	0	0
Holland Conc. XI[d]	28.0	21	1991	0	12	10	1	0	2	0
Keppel Conc. I[c]	27.0	20	1990	25	0	0	0	0	0	0
			1991	24	1	0	0	0	0	0
Conc. XVI[b]	26.7	20	1990	23	2	0	0	0	0	0
			1991	23	1	1	0	0	0	0
Conc. XII[d]	23.0	16	1991	8	16	1	0	0	0	0
Conc. XXI[c]	32.1	24	1990	25	0	0	0	0	0	0
			1991	25	0	0	0	0	0	0
Conc. XXI[c]	38.3	22	1990	25	0	0	0	0	0	0
			1991	25	0	0	0	0	0	0
Conc. XXII[b]	33.1	21	1990	24	0	1	0	0	0	0
			1991	24	0	0	0	0	1	0
Conc. XXII[d]	34.0	27	1991	11	13	1	0	0	0	0

(cont'd)

Table 9. Maple health at 18 woodlot locations in the Southwestern Region of Ontario from 1987 to 1991 (25 maple trees examined at each location) (concl.).

Location (Twp)	Average DBH (cm)	Average height (m)	Year	Cumulative dieback class[a] 0	1	2	3	4	5	Trees blown down or cut
				← Number of trees →						
Simcoe District										
Houghton	33.3	24	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	0
			1990	25	0	0	0	0	0	0
			1991	24	1	0	0	0	0	0
North Norwich	31.0	21	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	0
			1990	25	0	0	0	0	0	0
			1991	25	0	0	0	0	0	0
Wingham District										
Morris	29.5	21	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	24	1	0	0	0	0	0
			1990	23	2	0	0	0	0	0
			1991	23	2	0	0	0	0	0
West Wawanosh	30.3	21	1987	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	0
			1989	24	1	0	0	0	0	0
			1990	23	2	0	0	0	0	0
			1991	24	1	0	0	0	0	0

[a] 0 = 0–5%, 1 = 6–20%, 2 = 21–40%, 3 = 41–60%, 4 = 61–100%, 5 = dead tree
[b] sprayed with B.t. against the forest tent caterpillar in 1989.
[c] sprayed with B.t. against the forest tent caterpillar in 1989 and 1990.
[d] not sprayed

The stresses and site disturbances under which urban and rural roadside trees grow are vastly different from those experienced by woodlot trees, and this difference is reflected in the cumulative crown conditions. Table 10 summarizes crown conditions for these urban and rural trees. Examination of this data reveals that four additional declining trees were cut and removed by maintenance crews in the Goderich Township plot, Wingham Township. In North Easthope Township, Wingham District, roadside trees sustained severe leaf scorch on 95% of the trees. In all other plots, crown condition remained relatively constant.

North American Maple Project

Once again, the crown condition of sugar maple trees was evaluated in sugarbushes and undisturbed woodlots at seven locations in Southwestern Region. Observations at six of these plots revealed that crown conditions had remained relatively constant; 96.9% of the trees evaluated had <15% crown dieback in 1991 (Table 11). The only exception to this was in the seventh plot in Townsend Township, Simcoe District, where 25% of the mature to overmature trees had dieback levels ranging from 16 to 85%, an increase from the 16% recorded in these dieback classes in 1990.

Acid Rain National Early Warning System (ARNEWS)

Annual assessments in the three ARNEWS plots in the region have been conducted to evaluate acid rain damage through changes in branch, crown and tree condition. Since establishment of the plots,

Table 10. Maple health at 12 urban and rural locations in the Southwestern Region of Ontario from 1989 to 1991 (25 maple trees examined at each location).

Location	Plot type[a]	Average DBH (cm)	Average height (m)	Year	Cumulative dieback[b] 0	1	2	3	4	5	Trees blown down or cut
					← Number of trees →						
Aylmer District											
Bayham Twp	R	85.9	20	1989	23	2	0	0	0	0	0
				1990	22	2	1	0	0	0	0
				1991	22	2	1	0	0	0	0
Strathroy	U	82.5	24	1989	21	4	0	0	0	0	0
				1990	22	3	0	0	0	0	0
				1991	23	1	0	0	0	0	1
Woodstock	U	63.4	23	1989	20	2	2	0	0	1	0
				1990	19	1	2	0	0	1	2
				1991	18	1	3	0	0	1	2
Simcoe District											
Norwich	U	60.8	16	1989	17	4	3	0	1	0	0
				1990	15	6	3	0	1	0	0
				1991	13	7	4	0	0	0	1
South Walsingham Twp	R	62.8	20	1989	18	4	2	1	0	0	0
				1990	15	6	3	0	1	0	0
				1991	16	3	2	2	2	0	0
Windham Twp	R	81.9	23	1989	22	3	0	0	0	0	0
				1990	21	4	0	0	0	0	0
				1991	19	6	0	0	0	0	0
Owen Sound District											
Owen Sound	U	91.0	26	1989	–	–	–	–	–	–	–
				1990	21	3	1	0	0	0	0
				1991	17	8	0	0	0	0	0
Sullivan	R	84.4	20	1989	–	–	–	–	–	–	–
				1990	9	11	5	0	0	0	0
				1991	12	11	2	0	0	0	0
Wingham District											
Blyth	U	74.3	23	1989	14	5	4	2	0	0	0
				1990	14	4	5	1	2	0	1
				1991	14	3	5	2	0	0	1
Goderich Twp	R	72.4	19	1989	9	4	6	4	2	0	0
				1990	6	5	5	1	4	1	3
				1991	6	4	5	2	1	0	7
North Easthope Twp	R	69.2	18	1989	4	12	5	2	2	0	0
				1990	2	6	8	4	4	1	0
				1991	2	5	5	7	5	1	0
Wingham	U	68.0	21	1989	20	3	0	1	1	0	0
				1990	20	3	0	0	1	0	1
				1991	22	1	0	0	1	0	1

[a] R = rural, U = urban

[b] 0 = 0–5%, 1 = 6–20%, 2 = 21–40%, 3 = 41–60%, 4 = 61–100%, 5 = dead tree

Table 11. Summary of the crown condition of sugar maple at seven North American Maple Project plots from 1988 to 1991 in the Southwestern Region of Ontario.

Location (Twp)	Average DBH (cm)	Year	Number of trees examined	Total dead crown (%) Number of trees 0	1–5	6–15	16–25	26–35	36–45	46–55	56–65	66–75	76–85	86–95	96–100	Trees dead	Trees blown down or cut
Aylmer District																	
Bayham[b]	73.5	1988	39	13	22	1	1	1	0	0	0	0	0	1	0	0	0
		1989	39	18	18	0	2	1	0	0	0	0	0	0	0	1	0
		1990	39	3	33	2	1	0	0	0	0	0	0	0	0	1	0
		1991	39	0	32	5	2	0	0	0	0	0	0	0	0	1	0
Blandford[a]	29.6	1988	42	36	6	0	0	0	0	0	0	0	0	0	0	0	0
		1989	42	21	21	0	0	0	0	0	0	0	0	0	0	0	0
		1990	42	0	41	1	0	0	0	0	0	0	0	0	0	0	0
		1991	42	2	39	1	0	0	0	0	0	0	0	0	0	0	0
Chatham District																	
Warwick[a]	26.5	1988	48	38	9	0	1	0	0	0	0	0	0	0	0	0	0
		1989	47	20	27	0	0	0	0	0	0	0	0	0	0	1	0
		1990	47	3	41	3	0	0	0	0	0	0	0	0	0	1	0
		1991	47	3	42	1	1	0	0	0	0	0	0	0	0	1	0
Owen Sound District																	
Saugeen[b]	30.8	1988	38	12	24	1	1	0	0	0	0	0	0	0	0	0	0
		1989	38	5	26	4	2	1	0	0	0	0	0	0	0	0	0
		1990	38	0	30	7	0	0	1	0	0	0	0	0	0	0	0
		1991	38	0	24	12	1	1	0	0	0	0	0	0	0	0	0
Simcoe District																	
Townsend[b]	41.1	1988	32	15	8	3	2	2	1	0	1	0	0	0	0	0	0
		1989	32	14	9	3	1	2	1	0	1	0	1	0	0	0	0
		1990	32	4	16	7	1	0	1	1	1	0	1	0	0	0	0
		1991	32	1	19	4	3	1	1	0	1	0	1	0	1	0	0
Wingham District																	
Goderich[b]	32.3	1988	62	23	30	6	1	0	0	1	0	0	0	0	1	0	0
		1989	60	17	36	3	2	2	0	0	0	0	0	0	0	1	1
		1990	60	0	54	3	2	0	0	0	1	0	0	0	0	1	1
		1991	60	4	49	4	1	1	0	0	0	1	0	0	0	0	2
West Wawanosh[a]	29.9	1988	36	14	20	2	0	0	0	0	0	0	0	0	0	0	0
		1989	36	9	26	1	0	0	0	0	0	0	0	0	0	0	0
		1990	36	1	32	3	0	0	0	0	0	0	0	0	0	0	0
		1991	36	2	31	3	0	0	0	0	0	0	0	0	0	0	0

[a] undisturbed woodlot

[b] trees currently tapped for maple syrup

Table 12. Hardwood health at three Acid Rain National Early Warning System plots established in the Southwestern Region of Ontario.

Location (Twp)	Tree species	Number of trees examined	Average DBH (cm)	Year	Tree crown condition class[a] 1	2	3	4	5	6	7	8	9
					← Number of trees →								
Chatham District													
Howard	sM	9	36.3	1985	3	0	0	6	0	0	0	0	0
				1986	3	0	0	6	0	0	0	0	0
				1987	3	0	0	6	0	0	0	0	0
				1988	2	0	5	2	0	0	0	0	0
				1989	2	0	4	3	0	0	0	0	0
				1990	1	0	6	2	0	0	0	0	0
				1991	2	0	6	1	0	0	0	0	0
Simcoe District													
South Walsingham	Oak	16	27.8	1986	1	0	4	7	4	0	0	0	0
				1987	0	0	2	12	2	0	0	0	0
				1988	1	0	3	11	1	0	0	0	0
				1989	0	0	3	13	0	0	0	0	0
				1990	2	0	5	8	1	0	0	0	0
				1991	0	0	5	7	4	0	0	0	0
Wingham District													
West Wawanosh	sM	15	41.1	1985	7	0	0	7	0	0	0	0	1
				1986	7	0	0	7	0	0	0	0	1
				1987	6	0	0	7	0	1	0	0	1
				1988	6	0	4	3	0	0	1	0	1
				1989	5	1	3	4	0	0	0	1	1
				1990	2	0	7	4	0	0	0	0	2
				1991	5	0	7	1	0	0	0	0	2

[a] Crown classes: 1 = normal, healthy tree; 2 = foliage thin, off-color, particularly in upper crown, no bare twigs or branches; 3 = dead twigs present but no dead branches (dead twigs occur at the ends of branches, usually in the top of the crown and for a distance of about 0.5 to 1.0 m from the edge of the crown); 4 = dead branches present on up to 25% of the crown; 5 = dead branches present on up to 50% of the crown; 6 = > 50% of the crown dead but some living branches still present on the tree; 7 = > 50% of the crown dead, no living branches present on the tree; 8 = new dead tree; 9 = old dead or missing tree.

the presence of insect, disease or abiotic damage has been recorded. Table 12 summarizes the cumulative tree condition for all years since the establishment of each plot.

The most significant pests recorded on plot trees in 1991 were the gypsy moth, which caused < 20% defoliation in the South Walsingham Township plot, Simcoe District; and the maple webworm, which caused < 10% defoliation in the West Wawanosh Township plot, Wingham District. No symptoms of acid rain damage have been observed in any of the plots since their establishment.

SPECIAL SURVEYS

Forest Tree Nursery Report

A number of problems were encountered during five visits made to the St. Williams Forest Tree Nursery during the 1991 field season.

The most serious pest problem encountered was feeding by leatherjackets, the larval stage of the marsh cranefly (*Tipula paludosa* Meigen). These insects were present in sufficient numbers to cause 44.4% mortality of the 2 + 0 Norway spruce in compartment B12 and lesser amounts of damage (10%) in compartments B10, B11 and A6. The ash leaf spot (*Mycosphaerella effigurata* [Schwein.]

House) foliar disease caused 25% foliar browning on 10% of the green ash (*F. pennsylvanica* Marsh. var. *subintegerrima* [Vahl.] Fern.) seedlings in compartment C10. An assessment in the same compartment also revealed hickory leaf spot (*Marssonina juglandis* [Lib.] Magnus) causing 20% foliar damage on 90% of the black walnut (*Juglans nigra* L.) seedlings. In compartment A5, black walnut sustained < 5% foliar damage as a result of anthracnose infections. White spruce transplant stock sustained varying amounts of heat desiccation during an extremely hot and dry period of the summer. The highest incidence of damage was in compartment C5, where an assessment of $1^{1}/_{2} + 1^{1}/_{2}$ white spruce disclosed 26.7% seedling mortality. An evaluation of 1+1 Norway spruce stock revealed trace (<1%) mortality as a result of heat desiccation in several other compartments. Flooding caused low levels of eastern white cedar (*Thuja occidentalis* L.) seedling mortality in compartment D4.

Populations of the cedar leafminer (*Argyresthia aureoargentella* Brower) caused 25 to 40% foliar damage on cedar windbreaks. The larch casebearer was again recorded causing 25 to 60% defoliation on mature European larch windbreaks and shelterbelts, and small numbers of the eastern spruce gall adelgid (*Adelges abietis* [L.]) were observed on 2- to 6-m hedgerow spruce trees.

Climatic Data

Forest insects and diseases can be greatly influenced by prevailing weather conditions during times critical to their development. Forest health is also affected to a large degree by extremes in weather conditions. Baseline weather data (Table 13) are included in this report and may help in explaining variations in pest populations and abiotic damage. The data were supplied by the Atmospheric Environment Service of Environment Canada.

Table 13. Monthly mean temperatures and total precipitation at three locations in the Southwestern Region of Ontario in 1990, and 30-year normals[a].

Location	Month	Mean temperature (°C)		Deviation from normal		Total precipitation (mm)		Deviation from normal	
		Normal	Actual	(°C)	(%)	Normal	Actual	(mm)	(%)
Aylmer District									
London	Jan.	−6.6	−6.0	+0.6	+9	75.2	51.3	−23.9	−32
	Feb.	−6.1	−2.2	+3.9	+64	60.5	52.0	+−8.5	−14
	Mar.	−0.9	1.5	+2.4	+267	75.1	111.0	+36.1	+48
	Apr.	6.4	8.8	+2.4	+137	81.2	31.0	−50.2	−62
	May	12.4	16.8	+4.4	+35	66.9	89.6	+22.7	+34
	June	17.9	19.7	+1.8	+10	73.6	76.3	+2.7	+4
	July	20.3	20.8	+0.5	+2	72.4	99.6	+26.8	+37
	Aug.	19.5	20.7	+1.2	+6	80.3	52.0	−28.3	−35
	Sept.	15.4	14.9	−0.5	−3	78.6	34.9	−43.7	−56
	Oct.	9.4	10.5	+1.1	+12	73.4	88.8	+15.4	+21
	Nov.	3.1	2.0	−1.1	−36	84.7	91.1	+6.4	+8
	Dec.	−3.5	−2.7	+0.8	+23	87.5	73.6	−13.9	−16
Simcoe District									
Delhi	Jan.	−6.0	−5.2	+0.8	+13	68.8	39.2	−29.6	−43
	Feb.	−5.4	−1.9	+3.5	+65	56.8	41.6	−15.2	−27
	Mar.	−0.3	2.1	+2.4	+800	84.4	98.2	+13.8	+16
	Apr.	6.7	9.1	+2.4	+35	93.6	103.5	+9.9	+11
	May	12.8	17.1	+4.3	+34	73.5	65.0	−8.5	−12
	June	18.3	20.2	+1.9	+10	71.1	40.0	−31.1	−44
	July	20.7	21.0	+0.3	+1	70.7	182.2	+111.5	+158
	Aug.	19.8	20.6	+0.8	+4	93.1	63.0	−30.1	−32

(cont'd)

Table 13. Monthly mean temperatures and total precipitation at three locations in the Southwestern Region of Ontario in 1990, and 30-year normals[a] (concl.).

Location	Month	Mean temperature (°C)		Deviation from normal		Total precipitation (mm)		Deviation from normal	
		Normal	Actual	(°C)	(%)	Normal	Actual	(mm)	(%)
Simcoe District (concl.)									
Delhi	Sept.	15.9	15.2	−0.7	−4	80.1	42.4	−37.7	−47
	Oct.	9.9	10.4	+0.5	+5	74.9	98.9	+24.0	+32
	Nov.	3.7	3.0	−0.7	−19	82.4	86.5	+4.1	+5
	Dec.	−2.9	−1.5	+1.4	+48	85.2	73.8	−11.4	−13
Wingham District									
Blyth	Jan.	−7.9	−6.9	+1.0	+13	105.8	128.3	+22.5	+21
	Feb.	−8.2	−3.6	+4.6	+56	67.2	120.7	+53.5	+80
	Mar.	−2.8	0.3	+3.1	+110	62.7	108.0	+45.3	+72
	Apr.	5.1	7.9	+2.8	+55	71.9	140.5	+69.4	+96
	May	11.8	16.4	+4.6	+39	73.7	94.0	+20.3	+28
	June	17.0	20.0	+3.0	+18	75.0	50.0	−25.0	−33
	July	19.7	20.7	+1.0	+5	76.6	57.5	−19.1	−25
	Aug.	18.8	20.2	+1.4	+7	96.3	95.5	−0.8	−1
	Sept.	15.1	15.6	+0.5	+3	88.4	72.0	−16.4	−19
	Oct.	8.7	10.4	+1.7	+19	90.3	122.5	+32.2	+36
	Nov.	2.5	2.0	−0.5	−20	101.4	116.0	+15.4	+16
	Dec.	−4.3	N.A.	N.A.	N.A.	116.2	N.A.	N.A.	N.A.

[a] based on the 30-year average.